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## PREVALENCE OF ORTHOREXIA NERVOSA TENDENCIES IN U.S. DIDATIC PROGRAM IN DIETETICS STUDENTS

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## Abstract

Due to high rates of chronic disease, there is a push for healthy eating. Although the adoption of a nutritious diet may seem harmless, in some susceptible individuals it may transform into an unhealthy obsession, referred to as Orthorexia Nervosa (ON). In the current study, ON tendencies were examined in 596 U.S. Didactic Program in Dietetics (DPD) students. ON symptomology was assessed using ORTO-15, Eating Habits Questionnaire (EHQ), and Inflexible Eating Questionnaire (IEQ). Self-reported dietary intakes were examined via the Automated Self-Administered 24-Hour Dietary Assessment Tool (ASA-24), which was used to determine diet quality via the Healthy Eating Index (HEI)-2015. Spearman's rho correlations were run to examine the relationship between ORTO-15 and IEQ and ORTO-15 and EHQ. Independent-samples Kruskal-Wallis test was used to assess differences in ON risk and college classification. Chi-Square Tests were conducted to determine differences in ORTO-15, EHQ, and IEQ scores within college year, college/university regional location, and weight status. Independent Samples T-test examined differences in HEI scores in participants with and without ON tendencies. Correlations were conducted to assess relationships between HEI scores with ORTO-15, IEQ, and EHQ scores. More than half (58.7%) of participants had orthorexic tendencies determined via the ORTO-15, with freshman having the greatest risk and graduate students having the least risk. Diet quality did not significantly differ between participants with and without ON risk. The findings suggest that nutrition education from DPD coursework may be protective against orthorexic behaviors and that diet alone may not be enough to determine ON prevalence. Further research should examine how ON should be characterized and diagnosed prior to determining its prevalence and associated factors. ON tendency within this population was high; therefore, it should help inform the field of dietetics on how to better address this matter within students.

PREVALENCE OF ORTHOREXIA NERVOSA TENDENCIES IN U.S. DIDACTIC  
PROGRAM IN DIETETICS STUDENTS

by

Mariana Olga Serback

B.S., Syracuse University, 2016

Thesis

Submitted in partial fulfillment of the requirements for the degree of  
Master's of Science in *Nutrition Science*.

Syracuse University  
June 2018

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## **Introduction**

With over half of American adults overweight or obese (Centers for Disease Control and Prevention, 2017b) and more than 117 million Americans with a chronic health condition (Centers for Disease Control and Prevention, 2017c), it is no wonder that there is a push for healthy eating. While the benefits of a nutritious diet are well documented (Onvani, Haghighatdoost, Surkan, Larijani, & Azadbakht, 2016), extreme healthy eating can be problematic. In some individuals an emphasis of eating only the *cleanest, purest*, and most *righteous* foods while restricting other perceived “bad” foods, could have unintended consequences. It could perhaps lead to the adoption of a limited diet, preoccupation with food, and malnutrition. This is referred to as Orthorexia Nervosa.

The term ‘Orthorexia Nervosa’ (ON) has only been around for approximately twenty years. Dr. Steven Bratman coined it in 1996, and it is defined as an unhealthy fixation on healthy eating with the goal of becoming “healthy”, “pure”, or “clean” (Bratman, 2014). Unlike recognized eating disorders, ON is usually driven by health goals and/or disease prevention, as opposed to weight loss for better body image. (Bratman 2014; Brytek-Matera, Donini, Krupa Poggiogalle, Hay, 2015; Dunn & Bratman, 2016). The term was first published in a Yoga Journal article written by Bratman, where he described his own experience with ON as being “seduced by righteous eating” (Bratman, 1997). In 1998, “orthorexia” was further published in newspaper and magazine articles (Cosmopolitan, 1998; Fitzmorris, 1998), and in 2001, Bratman and David Knight published a book titled, “Health Food Junkies: Orthorexia Nervosa: Overcoming the Obsession with Healthful Eating” (Bratman & Knight, 2004). Donini and colleagues (2004) published the first identified study on ON in 404 Italian participants. The researchers measured the prevalence of orthorexia by assessing “health fanatic” eating patterns

with obsessive-compulsive traits.

ON may involve avoiding foods that contain fat, preservatives, food additives, animal products or other ingredients the consumer feels are unhealthy (Missbach, et al. 2015; Moroze et al., 2015). This restriction may lead to unbalanced diets (Bagci Bosi, Camur, & Guler, 2007), medical complications (Dunn & Bratman, 2016; Koven & Abry 2015), unintended weight loss (Dunn & Bratman, 2016), and malnutrition (Bratman, 2015; Dunn & Bratman, 2016; Moroze et al., 2015). Aside from avoiding certain foods, there is a strong devotion of time dedicated to researching, planning, and thinking about food, thus limiting time for other activities (Bratman, 1997; Donini, Marsili, Graziani, Imbriale, & Cannella, 2004). ON usually involves withdrawal from life activities, social isolation (Donini et al., 2004), and financial strain due to purchasing only “acceptable” foods (Borgida, 2011). A drive for healthy eating may not seem problematic, however, people with ON are typically in a state of psychological distress.

### **Orthorexia Nervosa Assessment Tools**

ON is not currently recognized by the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, n.d.) and there is a lack of established ON criteria. This presents flaws in ON assessment tools and implications for detecting its prevalence and epidemiology (Koven & Abry, 2015).

Bratman's Orthorexia Test (BOT) is a ten-item yes/no questionnaire that was created as a screening tool for ON in U.S. populations. It includes questions such as: “Do you spend more than 3 hours a day thinking about your diet?” “Has the quality of your life decreased as the quality of your diet has increased?” and “Do you feel guilty when you stray from your diet?” (Bratman Test, n.d.). The BOT instrument has never been tested for validity and reliability. A literature review co-authored by Bratman, stated that the BOT was created as an informal



measure of ON with no interpretation guidelines (Dunn & Bratman, 2016); therefore, there should be caution when using this as an ON assessment tool.

The BOT is the basis for other questionnaires, including ORTO-15 (Dunn & Bratman, 2016). ORTO-15 is a fifteen-item Likert-scale questionnaire examining beliefs and perceived effects around eating healthy foods, eating habits, and how food concerns affect daily life (Donini, Marsili, Graziani, Imbriale, & Cannella, 2005). It includes six questions from BOT and nine additional ones (Dunn & Bratman, 2016). It is reversely coded as scores below 40 are indicative of ON symptomology, and scores above 40 indicate healthy normal eating behaviors (Donini et al., 2005). ORTO-15 was validated in an Italian study with 121 subjects, where the subjects were enrolled voluntarily. The specific population, geographic location, and potential volunteer bias make their findings difficult to generalize. ORTO-15 has been translated for various populations as reviewed by Missbach et al., (2017) including: Italian, Turkish, Portuguese, German, Spanish, and Polish (Brytek-Matera, Krupa, Poggiogalle, & Donini, 2014; Missbach et al., 2017). There are some limitations with this tool. ORTO-15 has internal inconsistency, a lack of validity (Missbach et al., 2017), and fails to include questions regarding obsessive-compulsive traits associated with ON (Koven, & Abry, 2015).

Some researchers have added or removed questions to improve its reliability and validity (Koven & Abry, 2015; Varga, Thege, Dukay-Szabó, Túry, & van Furth, 2014), which has led to the tools ORTO-11-HU, ORTO-9-GE; and the Eating Habits Questionnaire (EHQ). ORTO-11-HU is an eleven-item questionnaire that has been translated for Polish and Turkish populations (Dunn & Bratman, 2016) with each item scored on a Likert scale. ORTO-11-HU has good internal reliability with Hungarian respondents (Varga et al., 2014), but more research is needed to determine the reliability and validity in other populations. ORTO-9-GE was created for

German populations and has moderate reliability and internal consistency (Missbach et al., 2015). EHQ is a 21-item questionnaire that does not measure ON directly, but rather examines knowledge, conflicts, and feelings associated with healthy eating to determine ON symptomology (Gleaves, Graham, & Ambwani, 2013). EHQ has good internal consistency, test-retest reliability, and validity in a study with U.S. university students (Gleaves et al., 2013).

Missbach et al., (2017) discussed the need for improved, valid, and reliable diagnostic tools in order for ON to be taken seriously. There is a lack in interval validity for current diagnostic measures, limiting many of the studies determining ON's prevalence. Bratman established ON criteria which includes: obsessive focus on "healthy" eating, compulsive behavior and/or mental preoccupation about restrictive dietary practices to promote health, self-imposed dietary rules and restriction, malnutrition, intrapersonal distress, and body image associated with eating behavior (Bratman, 2015). Moroze et al., (2015) further proposed similar criteria: preoccupation with "healthy eating" which may lead to unbalanced diets, rigid avoidance of foods, and excessive amounts of time thinking about food; guilt when "unhealthy" foods are consumed; spending excessive amounts of money on "high quality" food; impairment of physical health, social, academic, or vocational functioning due to restrictive diets and food preoccupation; symptoms mimicking that of another disorder such as Obsessive Compulsive Disorder (OCD) or schizophrenia; and adhering to dietary practices that are not related to religion or medically prescribed diets. This criterion should be considered when determining ON symptomology and establishing new measurement tools.

### **Prevalence of Orthorexia Nervosa**

Due to a lack of valid and reliable assessment tools, studies on the prevalence of ON are inconsistent, limited, and perhaps even flawed. Studies use various forms of ON assessment,

each with different and specific populations. This makes their findings nearly impossible to compare with one another, and difficult to generalize. Although the prevalence of ON has attempted to be determined, due to these limitations, their findings should be interpreted with caution.

The prevalence of ON in Italian populations has been examined. A study conducted at the University of Rome determined the prevalence of ON by measuring “health fanatic” eating and obsessive-compulsive traits (Donini et al., 2004). The measurement of “health fanatic” eating was unclear, but appeared to measure the participants’ choice of healthy and unhealthy foods. Minnesota Multiphasic Personality Inventory (MMPI) test was used to measure obsessive-compulsive traits. The researchers found that 6.9% of participants were identified with ON, however, participant recruitment was on a volunteer basis, making these findings not representable of the Italian population. Another Italian study measured the prevalence of ON in a random sample using ORTO-15 (Ramacciotti et al., 2011). This study showed that 57.6% of the population was at high ON risk, however, the sample was small, having only 177 participants.

ON has also been explored in Turkish populations. One study examined the prevalence of ON among 94 Turkish opera, ballet, and symphony orchestra performance artists (Aksoydan & Camci, 2009). The researchers found that opera singers had the highest prevalence of ON where ballet dancers had the lowest. Ballet dancers had the lowest body mass index (BMI) ( $18.7 \pm 2.01$ ) and reported the greatest amount of smoking (82.1% of dancers), indicating that perhaps they have higher incidences of body dissatisfaction and disordered eating. This demonstrates that ON may not share weight concerns, unlike traditional eating disorders. Older participants, men, and those with higher education and longer work experience showed a trend toward greater ON risk. ON symptomology was also associated with BMI in the overweight category and in participants

who did not smoke or use alcohol. A major limitation of this study was the very specific sample, which makes these findings difficult to generalize.

Bagci Bosi and colleagues looked at the prevalence of ON in 318 resident medical doctors in Ankara, Turkey using ORTO-15 (Bagci Bosi et al., 2007). There was no statistically significant difference in ON risk between men and women; however, women were significantly more likely to care for their physical appearance, focus on weight control, and consume low-calorie foods. This may explain why some studies find greater ON risk in men. Eating disorders are more common among females compared to males (National Eating Disorder Association, 2018d), who are driven by a desire to be thin, as opposed to achieving good health. This study confirmed that within this population, there might be more weight-control behaviors (e.g., care for physical appearance, weight control, and consumption of low-calorie foods), which may indicate that women in this population are at elevated risk for disordered eating as opposed to ON. Of the sample population, 45.5% of medical doctors had ON based on the ORTO-15 test. ON risk was significantly higher in participants who do their own grocery shopping, substitute lunch or dinner for some fruit or a salad, care about the nutritional quality of foods they eat, believe that dining out is healthy, examine the content of foods they purchase, and use nutrition information on packaged foods when grocery shopping.

The prevalence of ON among medical students in Erzurum, Turkey using ORTO-11 was examined with 878 participants who participated voluntarily (Fidan, Ertekin, Işıkay, & Kırpınar, 2010). The researchers found a negative correlation between BMI and ON scores. Therefore, participants with higher BMIs had greater ON tendencies, as lower ORTO-11 scores indicate greater ON risk. ON symptomology was greater in participants under the age of 21 and in males. The researchers also found no association of parental education and ON.

ON in Turkish dietitians was investigated using ORTO-15 (Asil & Sürücüoğlu, 2015). The researchers found that of the 177 dietitian participants, 41.9% had elevated ON risk. There was a positive correlation between ON risk and BMI, a significant negative correlation between ORTO-15 and EAT-40 (a 40-item questionnaire that measures anorexia nervosa (AN) symptoms) scores and BMI. ON risk was associated with increased risk for eating disorders, and a postgraduate degree did not significantly influence ORTO-15 score within this population.

ON symptomology was further explored via ORTO-15 in 636 U.S. Registered Dietitian Nutritionists (RDNs) (Tremelling, Sandon, Vega, & McAdams, 2017). The researchers also examined eating disorder prevalence via Eating Disorder Examination Questionnaire (EDE-Q) to determine if there were shared symptoms among ON-risk subjects. More than 49% of dietitians were at risk for ON. ON-risk participants had elevated EDE-Q scores (including items related to body and shape preoccupation) and were associated with a lower BMI.

A study conducted at California State University examined the prevalence of ON and associated tendencies in 448 college students (Bundros, Clifford, Silliman, & Morris, 2016). There were only five students that met ON criteria using BOT. Hispanic/Latino and overweight/obese students were at the greatest risk. The researchers suggested that perhaps overweight and obese students experienced weight stigma and/or discrimination, making them more obsessed with food and diet. There was also no relationship between ON score and college major.

Researchers at another U.S. university in the south examined ON in relation to personality traits in 459 college students enrolled in undergraduate psychology courses (Oberle, Samaghabadi, & Hughes, 2017). The researchers used EHQ to determine associations between ON symptomology, gender, BMI, and personality traits. EHQ was used to measure three ON

variables: behaviors, conflicts, and positive feelings related to healthy eating. The researchers found that men had greater ON behaviors while women had more positive feelings regarding healthy diet. BMI also had significant associations with ON factors, with a higher BMI associated with greater ON risk in each of the three variables. In terms of personality traits, self-esteem was positively correlated with healthy eating behaviors and both narcissism and perfectionism were positively correlated with all three variables.

A Swedish study measured ON prevalence, physical activity, and health status in exercise science and business majors in 207 undergraduate university students (Malmborg et al., 2017). The researchers measured ON via ORTO-15 and found 76.6% of students had scores indicating ON symptomology. There were no significant ON differences in men in terms of their major, where female exercise science majors showed greater ON risk. Men had an overall higher prevalence of ON symptomology. There were no significant differences in health status between ON-risk and non-ON-risk groups.

Some studies indicate involvement in athletics (Segura-García, Papaiani, Caglioti, et al., 2012), adhering to a plant-based diet (Missbach, et al. 2015), and dieting experience (Missbach, et al. 2015) may be associated with ON symptomology. There are contradicting findings of ON associated with education level (Aksoydan & Camci, 2009; Donini et al., 2004; Ramacciotti, et al., 2011) BMI (Aksoydan & Camci, 2009; Asil & Sürücüoğlu, 2015; Donini et al., 2004; Fidan, et al., 2010; Tremelling et al., 2017; Varga, Dukay-Szabó, Túry, & van Furth, 2013), age (Aksoydan & Camci, 2009; Donini et al., 2004; Fidan et al., 2010; Ramacciotti, et al., 2011), and sex (Bagci Bosi et al., 2007; Donini et al., 2004; Fidan et al., 2010; Malmborg et al., 2017; Oberle, Samaghabadi, & Hughes, 2017) making ON an area in need of further research.

According to a review article, there appears to be no clear association between age,

gender, education, occupation, and ON symptomology (Varga et al., 2013). However, a BMI over 24.9, single individuals, and those living alone appear to be at greater risk. Perhaps this is due to the preoccupation of food and rigid eating behaviors in individuals with ON, which may lead to withdrawal from social events, isolation, and an inability to form strong relationships. People suffering from ON also tend to gravitate towards other people with similar diet philosophies and obsessions, and may discontinue relationships with those who have opposing views (Mathieu, 2005). Due to contradicting findings, further research is needed to confirm these risk factors.

### **Orthorexia Nervosa and Mental Health Disorders**

ON may share characteristics with mental disorders, including health phobia (Dunn & Bratman, 2016), OCD (Bratman, 2014; Donini et al., 2004), Obsessive Compulsive Personality Disorder (OCPD) (Koven & Abry, 2015), Health Anxiety (Koven & Abry, 2015), and Schizophrenia (Saddichha, Babu, & Chandra, 2012). A literature review discussed case studies with ON development (Dunn & Bratman, 2016), which may demonstrate how health phobia can trigger orthorexic behaviors in susceptible individuals. A 33-year old woman adopted a diet consisting of only fresh fruits, raw vegetables, and raw eggs for eight years. The patient reported that she had become obsessed about healthy eating and did not express any concern over her weight. She believed that cooking foods would diminish their nutritional qualities and withdrew from her friends and family. The patient had a BMI of 14.5 and upon medical attention, she appeared to have schizophrenia. Unexpectedly, her schizophrenia was unrelated to food but rather paranoia and odd beliefs about her family.

Another case study in this review included a 30-year old male who also did not report having any concerns over his weight. He restricted his diet to three to four tablespoons of brown

rice and fresh, unsalted vegetables in attempt to treat a tic disorder. This led to metabolic acidosis, subcutaneous emphysema, pneumothorax, and pancytopenia. Fear of health degradation appears to cause some individuals to take extreme diet measures that eventually lead to ON, which then may lead to health degradation. ON can appear different in each case, presenting further challenges when evaluating patients with these behaviors.

In general, there is a relationship between OCD and eating disorders (Altman & Shankman, 2009). Although ON is not recognized as an eating disorder, people with ON tend to have an obsessive relationship about food in ways such as thinking about, planning, preparing, and purchasing food (Donini et al., 2004.). A review article further discussed similarities between ON and other mental disorders (Koven & Abry, 2015). For instance, OCD and ON may involve consistent thoughts about food and health, over concern regarding food purity, and limited time for other additional activities due to food preoccupation, routines, and/or rituals. Obsessive Compulsive Personality Disorder (OCPD) and ON may have similar characteristics, such as perfectionism, rigidity, devotion of time, hypermorality, and preoccupation with details and perceived rules. ON may also share features with other psychiatric disorders including illness anxiety, somatic symptom, and psychotic spectrum disorders. Health anxiety is often seen in those suffering from somatoform disorders, which may be relevant to ON. If someone has chronic somatic symptoms, they may become fearful, leading them to seek non-traditional treatment, or may present anxiety about an undiagnosed illness (Koven & Abry, 2015). This could motivate someone to change their dietary habits in hope of better health outcomes, especially if they have been previously dissatisfied with conventional treatment methods. No found research has yet indicated a relationship between somatoform conditions and anxiety associated with ON; however, anxiety has been linked with preoccupation with food and diet



(Hadjistavropoulos & Lawrence, 2007). Having fear of deteriorating health, or health anxiety, has been positively correlated with dieting and preoccupation with food perhaps to self-manage health anxiety (Hadjistavropoulos & Lawrence, 2007). This is likely due to providing a sense of control over health status, which may potentially start the development of ON in some individuals.

ON also appears to share characteristics with other eating disorders, such as AN and bulimia nervosa. They both may include food rules, preoccupation with food, change in behavior or lifestyle to accommodate diet, self-identity with diet (e.g., “I am anorexic”, “I am a clean eater”, etc.). ON and eating disorders also lead to social and health consequences, isolation, weight change (Fidan et al., 2010), involve obsessive personality traits, and have bio-psycho-social aspects (Varga et al., 2013). Like with AN, ON can also lead to weight loss and malnutrition (Fidan et al., 2010), and sometimes people “recover” from AN by developing ON (Bratman, 2014). Varga et al, (2013) discussed differences between ON and eating disorders. The motive behind each disorder is different. For instance, the motive behind ON is usually driven by the promotion of health whereas eating disorders are usually caused by a fear of gaining weight. People with ON focus on food quality, where many eating disorders focus on food quantity. The studies on ON are limited and use unrepresentative samples, making it difficult to generalize their findings, therefore, more research is needed to determine the association between ON and mental health disorders.

### **Treatment of Orthorexia Nervosa**

To date, there are no studies that determine the effectiveness of ON treatment (Koven & Abry, 2015). Perhaps this is due to ON not being recognized by the DSM-5 (American Psychiatric Association, n.d.). Treatment usually involves a multidisciplinary team, as with

eating disorders, including physicians, psychotherapists, and RDNs (Borgida, 2011). Medications, cognitive-behavioral therapy, and psychoeducation are all part of ON treatment (Mathieu, 2005). Serotonin reuptake inhibitors and antipsychotics have appeared to be helpful to reduce obsessive thinking patterns regarding food. A potential conflict with prescribing medications is that some individuals might reject them because they contradict their strong beliefs about “natural” food (Mathieu, 2005). Exposure and prevention reversal training might be the most successful approach to reduce obsessive-compulsive behaviors (Mathieu, 2005). Cognitive restructuring may be beneficial regarding distortions around food and health (Borgida, 2011). Treatment should be individualized based on the patient’s symptoms and needs, and not only how the patients eat, but also their shopping patterns and their feelings regarding food (Borgida, 2011).

### **Disordered Eating in Nutrition Students**

Nutrition students’ dietary habits are particularly interesting because they are exposed to extensive information and opinions on food, nutrition, and weight. A literature review examined eating disorders/disordered eating in dietetic students and found that some students experience pressure to look a particular way in order to feel credible to work in the dietetics field (Mahn & Lordly, 2015). Furthermore, there are students who enter the nutrition field to find ways to deal with their own pre-existing food problems. Despite knowing they are unhealthy, some dietetic students reported using harmful weight loss techniques including vomiting, laxatives, and meal skipping. This review further discussed a study of 101 surveys from fourteen countries and found that over three-fourths of dietitians, nutrition professors, internship coordinators, and preceptors believed eating disorders were a problem at their facility; yet only 15% had policies or procedures to address them.

Dietary restraint, ON, other eating patterns, and diet intake in both nutrition and non-nutrition students were examined in German university students (Korinth, Schiess, & Westenhoefer, 2010). The researchers discovered that nutrition students have higher dietary restraint compared with non-nutrition students, which appeared to reduce as they moved through their program. The researchers reported no significant differences between nutrition students and students of other disciplines in terms of ON, disturbed/disordered eating, loss of control when eating, or obsessive-compulsive traits. Like with dietary restraint, ON tendencies reduced as the students' duration in college increased. For nutrition students, healthy food choices increased as they moved through their program, while they decreased in non-nutrition students. These findings suggest that perhaps nutrition students enter their program with disordered ideologies with regards to food and nutrition, which dissipate as they gain knowledge through their program.

A study investigating Portuguese university undergraduate students showed that female nutrition students had higher rates of binge eating and dietary restraint compared with non-nutrition students (Poínhos, Alves, Vieira, Pinhão, Oliveira, & Correia, 2015). An Australian study found that 23% of nutrition students were at risk of exercise addiction, 72% had exercise addiction symptoms, and exercise addiction in females was correlated with disordered eating (Rocks, Slater, Martin, & Pelly, 2017). Another Australian study found that, 52% of nutrition students avoided specific foods and food groups, 56% reported exercising at least 60 minutes a day for weight control, and 46% reported uncontrolled binge eating (Rocks et al., 2017). Approximately 60% of first-year nutrition students adhered to a self-prescribed diet compared with only about 30% of students in subsequent years. The researchers concluded that first-year nutrition students were eleven times more likely to have eating disorder symptoms compared to

nutrition students of higher college classification.

A paper from the Academy of Nutrition and Dietetics (AND) suggest that students who are studying to become RDNs with disordered eating may cause harm to their clients by pushing their own perceptions of food onto them (Houston, Bassler, & St Germain, 2015). Furthermore, if the student has issues relating to body image, they may bring weight bias into their sessions. Both disordered eating and body image disorders may impair the student from adhering to the nutrition care process and use of evidenced-based guidelines.

### **Specific Aims**

Extreme healthy eating, or ON, is a relatively new proposed disorder that can have serious negative consequences. Since there are no official established diagnostic criteria, there are limitations in all available ON assessment tools, presenting challenges when examining its prevalence and associated factors. ON may include obsessing over diet, self-imposed dietary restriction, and psychological distress. It differs from eating disorders, as weight is not the reason for changes in diet, but rather achieving optimal health. Overall, there is far more to learn about ON, making it an area of much needed research. Nutrition students experience more disordered eating compared with other students (Korinth et al., 2010; Rocks et al., 2017). Many nutrition students have the end goal of becoming an RDN. If these students have disordered eating habits, they may pass them onto their clients, presenting ethical implications.

RDNs are nutrition professionals who may work in a variety of settings with clients of different medical conditions. They have extensive knowledge regarding food and nutrition due to their required education and training and are considered to be dietary role models. This may increase their risk of adopting orthorexic tendencies. Many RDNs promote the adoption of a healthy diet in effort to reduce obesity and prevent or treat chronic disease. It is important that

RDNs adhere to the Hippocratic Oath of *do no harm*, and while promoting a nutritious diet seems harmless, it could innocently stimulate ON behaviors in susceptible individuals. Dietetic students are future RDNs and by having their own particular perceptions of food, they may unintentionally pass them onto their clients.

This study aimed to determine the prevalence of ON in Didactic Programs in Dietetics (DPD) students and if there was an association between ON, Inflexible Eating Questionnaire (IEQ), EHQ score, diet quality, academic year, and geographic region. Based on previous findings it is hypothesized that there will be greater ON symptomology in first-year students, participants with a BMI over 24.9, and greater inflexible eating and diet quality scores.

The hope of this study was to contribute to the literature on ON by determining associated factors and prevalence within this population. The researchers hope to gain a greater understanding of ON risk factors within DPD students to identify a potential target population for ON prevention target efforts.

### **Research Questions**

The following research questions were addressed in the current study:

- 1) What was the prevalence of ON tendencies in U.S. DPD students?
- 2) Were there differences in ON risk between students who reported being at a freshman, sophomore, junior, senior, and graduate standing?
- 3) Were there differences in ON risk between students who reported attending colleges/universities in the Northeast, Midwest, South, and West?
- 4) What was the relationship between weight status and ON risk in DPD students?
- 5) Was there a relationship between ORTO-15 and IEQ scores?
- 6) Was there a relationship between ORTO-15 and EHQ scores?

7) What was the relationship between diet quality and ON risk?

## **Methods**

### **Participants and Study Design**

This cross-sectional study examined ON in DPD students via an online survey and 24-hour dietary recall. The Institutional Review Board (IRB) at Syracuse University approved this research.

The researchers recruited the participants via DPD directors using the email addresses provided by the Academy of Nutrition of Dietetics webpage (Academy of Nutrition and Dietetics, 2018a). Two hundred and sixteen DPD directors were invited to share information about participation in the study with their DPD students. A flyer was attached that further explained details of the study and the survey link needed to participate. A consent form was provided as the first page of the electronic survey explaining the study's purpose, incentive of winning one of four \$25 Amazon gift cards, risks, benefits, and the researcher's contact information. The last sentence of the consent form included a statement claiming that by continuing on with the survey, the student agrees to participate in the study.

Three questionnaires were used to assess ON risk. Questions were provided to participants via the online survey software, Qualtrics. This survey included questions regarding demographics, college classification and region, self-reported weight and height, dietary restraint, and ON symptomology. Participants were then invited to complete a self-automated 24-hour recall. The full survey is included in Appendix A.

### **Measures**

#### *Weight Status*

There were two open-ended questions regarding participants' self-reported weight and

height. One question asked for the participants' self-reported weight in pounds (lbs.), and the other question asked for the participants' self-reported height in feet (ft.) and inches (in.), both of which were used to calculate BMI ( $\text{weight (kg)} / [\text{height (m)}]^2$ ) (Centers for Disease Control and Prevention, 2017a). A BMI below 18.5 was classified as “underweight”, a BMI between 18.5 and 24.9 was considered “normal weight”, and a BMI above 25.0 was characterized as “overweight” (Centers for Disease Control and Prevention, 2017a).

### *Orthorexia Nervosa Symptomology*

Due to ON being a proposed diagnosis and the lack of established valid and reliable ON assessment tools, the researchers used three questionnaires to assess ON symptomology. These questionnaires have been chosen based on characteristics associated with ON to develop a greater understanding of its prevalence within this population. None of these questionnaires are true assessments of ON, however, together they should be able to depict whether or not someone is at ON risk.

ORTO-15 has been partially validated and is the most commonly used ON assessment tool in the literature to date (Donini et al., 2005; Missbach, et al. 2015; Stochel, et al., 2015). It is based off of BOT and has been adapted for various populations (Dunn & Bratman, 2016). It includes questions regarding beliefs and perceived effects around eating healthy foods, eating habits, and how food concerns affect daily life (Donini, et al., 2005). A score below 40 is indicative of ON symptomology. A validation study determined this using three different thresholds (<35, <40, and <45) (Donini et al., 2005). A threshold below 35 had an efficacy of 86.5%, specificity of 94.2%, and negative predictive value of 91.1%. When set to <45, the threshold was unreliable as its efficacy was only 37.4%. The threshold below 40 had an efficacy of 73.8%, specificity of 75.8%, and negative predictive value of 93.8%. When ORTO-15 was

used in the validation sample using both the cut offs <35 and <40, the cut off below 35 had sensitivity of 0%, where the <40 cut off showed 100% for the sensitivity and 100% for negative predictive value. Therefore, a cut off <40 was determined as the cut-off score for ON symptomology when using this measure.

EHQ is a 21-item questionnaire with good internal consistency ( $\alpha = 0.82$  to  $0.90$ ) and test-retest reliability ( $r = 0.72$  to  $0.81$ ) and showed good validity in a study with U.S. university students (Gleaves et al., 2013). It measures knowledge, conflicts, and feelings about healthy eating to examine orthorexic tendencies (Gleaves et al., 2013).

IEQ is an eleven-item questionnaire that measures dietary restraint, eating and general psychopathology, body image inflexibility, and intuitive eating on a five-point Likert scale (Duarte, Ferreira, Pinto-Gouveia, Trindade, & Martinho, 2017). It has good internal reliability (Cronbach's alpha value =  $0.90$ ), construct reliability (composite reliability =  $0.96$ ) and convergent validity (average variance extracted =  $0.77$ ) It includes questions such as: "When I cannot follow my eating plan I feel very anxious (or nervous)"; "For me, having a balanced eating pattern requires strictly following certain rules"; and "I feel proud when I can rigidly follow certain eating rules". ON usually involves self-imposed dietary rules and restrictions that may cause anxiety or shame when not followed (Dunn & Bratman, 2016), thus, this questionnaire may further determine ON risk within this population.

#### *Diet Intake and Diet Quality*

Dietary data was collected via the 2016 version of the Automated Self-Administered 24-Hour (ASA-24) Dietary Assessment Tool. ASA-24 is a validated tool that allows the user to enter personal dietary recall data via the United States Department of Agriculture's (USDA) Automated Multiple-Pass Method (AMPM) (National Cancer Institute, 2017a). It begins with a



meal-based quick list, meal gap review, a detailed pass, final review, frequently forgotten foods, the last chance to add any other foods or beverages, and whether the amount of food and beverage consumed was much more, much less, or usual compared to participants' regular eating and drinking habits. ASA-24 was used to calculate participants' dietary quality using the Healthy Eating Index (HEI) - 2015, to determine if there was an association between ON risk and diet quality.

The HEI-2015 is scored out of 100 points and aligns with the 2015-2020 Dietary Guidelines for Americans (DGA) (National Cancer Institute, 2018a). Scores are based on adequacy of nine food components (total fruits, whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, and fatty acids) and the amount of four less healthy nutrients and foods (refined grains, sodium, added sugar, saturated fats). Each component of the HEI-2015 is scored on the basis of 1,000 calories, except for fatty acids, which is scored as a ratio between unsaturated and saturated fatty acids. Therefore, calories are controlled for while determining HEI scores.

### Statistical Analysis

The HEI was calculated using SAS (version 9.4). The National Cancer Institute provides the SAS code for data generated from the ASA-24 and the simple scoring algorithm per person was used (National Cancer Institute, 2018b). All other data were analyzed using SPSS statistical software (IBM; version 24), with the level of statistical significance set as  $p\text{-value} = 0.05$ . Descriptive statistics were used for participant characteristics (sex, race/ethnicity, college classification, college/university region, and weight status). Normality was assessed via Kolmogorov-Smirnov tests, revealing that none of the variables were normally distributed with the exception of the HEI scores. Therefore, nonparametric tests were performed for the majority

of these analyses. Measures of central tendency for the ORTO-15, EHQ, and IEQ were generated and prevalence of ON tendencies via ORTO-15 with a score below 40 indicating ON risk (Donini et al., 2005). Spearman's rho correlations were run to examine the relationship between ORTO-15 and IEQ scores as well as ORTO-15 and EHQ scores. To assess differences in ON risk (via ORTO-15) and college classification, an independent-samples Kruskal-Wallis test was used. Chi-Square Tests were conducted to determine differences in ORTO-15, EHQ, and IEQ scores within college year, college/university regional location, and weight status. For the HEI, all parametric tests were performed due to normally distributed data. Independent Samples T-test examined differences in HEI scores in participants with and without ON tendencies. Correlations were conducted to assess relationships between HEI scores with ORTO-15, IEQ, and EHQ scores.

## **Results**

### *Participants*

A total of 659 DPD student participants took part in this study. To meet the inclusion criteria participants had to be currently enrolled in a U.S. DPD program and be at least eighteen years of age. Eighty-five participants were excluded due to completing less than 19% of the survey and five additional participants were excluded due to having a BMI under 16, leaving a total of 569 participants who were included for data analyses.

Participants were predominately upper classmen (seniors 40.6%, juniors 35.3%), white (87%), female (95.4%), and of a healthy BMI (72.6%), as shown in Table 1. From our sample 211 students participated in the 24-hour recall. Forty of the recalls were removed due to duplicate recalls under the same username, calorie outliers (under 600 and over 4,400) (National Cancer Institute 2017b) and/or incomplete recalls, which provided 171 dietary recalls that were

included in the analyses.

### *Prevalence of ON Symptomology in DPD Students*

The results showed that more than half (58.7%) of participants had orthorexic symptomology determined via the ORTO-15. The median score for ORTO-15 was 39.0, which is below the cut-off of 40, indicating ON risk (see Table 2). The median scores for EHQ and IEQ were 45.0 and 32.0, respectively. EHQ and IEQ do not have score cutoffs, however, higher EHQ scores indicate greater ON symptomology, while higher IEQ scores indicate greater dietary restraint, eating and general psychopathology, body image inflexibility, and lower intuitive eating.

### *ON Risk in Relation to College Classification and Geographic Region*

There was a statistically significant difference between ORTO-15 and college classification groupings ( $p\text{-value} = 0.003$ ) (see Table 3). As participants move through their DPD program, they tend to be at lower ON risk. Freshman students were at the highest risk for ON (median score of 37), closely followed by sophomores, juniors, and seniors. Graduate students' mean ORTO-15 score indicated that they were on average not at risk (median score of 40). There were no statistically significant differences between ON risk and students who reported attending colleges/universities in the West Coast, West Central, North Central, South Central, North East, and South East.

### *Weight Status and ON Risk*

There was a statistically significant difference in the groupings between weight status and IEQ score ( $p\text{-value} = 0.002$ ,  $r = 128.3$ ,  $df = 86$ ). There were no statistically significant differences between weight status and ORTO-15 or IEQ.

### *Diet Quality and Nutrients Intakes Based on HEI and ON Risk*

The mean HEI scores for participants with and without ON symptomology via ORTO-15 were 64.32 and 65.77, respectively. There were no additional statistically significant differences between ON and non-ON risk participants and HEI components (see Table 4). Furthermore, no statistically significant relationships were found between HEI scores and each of the ON measures (ORTO-15, EHQ, and IEQ). Therefore, overall diet quality did not significantly differ in participants with and without ON risk. When examining nutrient intakes the results showed that ON risk participants consumed fewer total calories ( $p\text{-value} = 0.023$ ) and less dietary fat ( $p\text{-value} = 0.038$ ) compared to DPD students who were not at risk for ON.

*Relationships between measures of ON Tendencies (ORTHO-15, EHQ, IEQ)*

A statistically significant positive correlation was found between ORTO-15 and IEQ scores ( $r = 0.607$ ,  $p\text{-value} < 0.001$ ). This finding demonstrates that less orthorexic symptomology (greater ORTO-15 score) was correlated with greater dietary restraint, eating and general psychopathology, body image inflexibility, and lower intuitive eating (greater IEQ score). For EHQ and ORTO-15 scores, there was a statistically significant negative relationship ( $r = -0.454$ ,  $p\text{-value} < 0.001$ ). Therefore, ON risk (lower ORTO-15 score) was related to greater ON symptomology via the EHQ (higher EHQ score).

## **Discussion**

DPD students are future RDNs, who will most likely work with individuals or groups to improve their diet and health. If RDNs have disordered thoughts or perceptions regarding food and nutrition, they may incorporate them into their sessions, presenting ethical implications and potential harm to their clients (Houston et al., 2015). To our knowledge, this was the first study to examine orthorexic tendencies in U.S. DPD students. This sample was representative of the typical U.S. RDN population with demographics being predominately Caucasian females

(Academy of Nutrition and Dietetics, 2018b). The findings showed that of the sample, 58.7% of DPD students have orthorexic tendencies. This is significantly higher compared with undergraduate students of various disciplines at California State University, which found that approximately only 1% of students have ON symptomology via BOT (Bundros et al., 2016). Some dietetic students feel pressure to look a particular way in order to feel credible to work in the field (Mahn & Lordly, 2015); this perhaps may also translate into their dietary practices, which could explain the differences in ON risk within these two populations. Additionally, there were differences in ON assessment as the researchers used BOT. This makes comparing findings limited, presenting the need of official diagnostic criteria and measures.

When compared with U.S. RDNs, our study showed higher rates of ON symptomology using ORTO-15 (Tremelling et al., 2017). RDNs who were classified as at risk for ON also had higher scores on the Eating Disorder Examination Questionnaire and lower BMIs. The researchers also found that of the dietitians who reported past or current eating disorder treatment, approximately 60% had scores indicating ON risk. ON and other eating disorders have several differences as previously noted; however, it may be that individuals with eating disorders adopt ON as they recover (Bratman, 2014), which could be the case in RDNs. Dietary restraint and ON tendencies have been shown to decline in nutrition students as they move through their program (Korinth et al., 2010), which could explain the lower rates in RDNs. Although the study found lower rates of these symptoms compared with our sample, almost half of RDNs possessed ON traits, which is still quite high. The prevalence of RDNs with an eating disorder in that same study was only 13%. Although professionals working with clients and food who have any type of disordered eating is concerning, ON symptoms may not appear to be problematic, as they may be perceived as improving health. Furthermore, the psychological effects, including obsessiveness

and preoccupation with food that interfere with life activities (Bratman, 2015; Moroze et al., 2015) may not be as evident. This provides a need for greater awareness of ON and its symptoms.

In the current study, ON-risk participants had lower mean calories and lower total dietary fat compared with non-ON risk participants. ON may involve restricting food or food groups (Bratman, 2015; Moroze et al., 2015) including foods that contain fat, preservatives, food additives, animal products, etc. (Missbach, et al. 2015; Moroze et al., 2015). This restriction may lead to overall lower calories and reduced total dietary fat, which could explain this difference between groups.

Eating according to the Dietary Guidelines for Americans (DGA) includes consuming a balanced diet with foods from all food groups, ensuring adequate nutrition. One way to assess adherence to the DGA is via the HEI. We found that our population had overall higher HEI scores compared with the average of Americans aged two years and older ( $\sim 65$  vs. 57.8) (Wilson et al., 2016). Specifically, our sample had greater total vegetable, greens and beans, whole grain, and fatty acid consumption. HEI-2010 scores were examined in Wisconsin RDNs, with the mean score being  $80.08 \pm 11.28$  (Schumacher & Davis, 2015). It should be noted that both of these studies used HEI-2010 while the most updated HEI-2015 was used in the current study. We also unexpectedly found no significant differences in diet quality between ON and non-ON risk participants. Part of the proposed criteria of ON is that individuals consume “nutritionally unbalanced diet[s] due to the preoccupying beliefs about food “purity”” (Moroze et al., 2015). Therefore, being a DPD student could be protective in terms of adhering to unbalanced ON dietary practices. This may be due to education and extensive coursework regarding the significance of adequate nutrition through diet. This would also support why ON risk reduces as

students move through their program and why RDNs have lower rates (although still high) compared with DPD students. Korinth et al (2010) suggested that some nutrition students have pre-existing disordered ideas about food that reduce as they move through their program; which further supports that education offered to these students may be protective against ON.

Furthermore, dietary practices alone may not be enough to indicate ON risk, as they can with eating disorders. Our sample showed no statistically significant differences in diet quality in participants who were and were not at ON risk. Diagnostic criteria for AN involves restriction of calories (National Eating Disorder Association, 2018a); for bulimia nervosa it includes episodes or binge eating and a compensatory purge behavior (National Eating Disorder Association, 2018c); and for binge eating disorder it involves episodes of uncontrolled eating (National Eating Disorder Association, 2018b). This presents implications for how ON should be recognized and treated (e.g., eating disorder, psychological disorder, etc.).

Our study showed no statistically significant relationship between weight status and ON-risk as measured via ORTO-15 and EHQ. This differs with the results from some studies showing that a higher BMI was associated with greater ON symptomology (Aksoydan & Camci, 2009; Asil & Sürücüoğlu, 2015; Fidan et al., 2010; Oberle, Samaghabadi, & Hughes, 2017; Varga et al., 2013). Lower BMI and ON-risk were associated in RDNs (Tremelling et al., 2017). RDNs may eat according to the DGA, which is associated with a lower BMI (Schumacher & Davis, 2015), and may explain these differences.

As expected, there was a statistically significant negative relationship between EHQ and ORTO-15. This demonstrated that greater ON risk via the ORTO-15 (lower ORTO-15 score) is associated with greater ON risk via the EHQ (higher EHQ score). Unexpectedly, there was a positive correlation between ORTO-15 and IEQ scores. Therefore, less ON risk via ORTO-15

(higher ON score) was associated with greater dietary restraint, eating and general psychopathology, body image inflexibility, and reduced intuitive eating (higher IEQ score). This may be due to the language of the IEQ and its strong positive association with the Eating Disorder Examination Questionnaire (EDE-Q). The majority of the IEQ questions include the term “eating rules”. If a participant did not recognize their eating behavior as an “eating rule” it presents serious implications for how they chose to answer. In addition, if a participant adhered to “eating rules” based on religious or medically prescribed dietary practices, the questions did not distinguish between these and self-imposed eating rules. This makes it difficult to assess the motive behind participants’ eating behaviors. Furthermore, the IEQ’s positive association with the EDE-Q could also explain this finding, as the EDE-Q measures not only dietary restraint, but also weight and shape concerns (Fairburn & Bèglin, 1994). ON and recognized eating disorders have distinct differences, especially when it comes to weight (Varga et al., 2013). This positive correlation may support that there are differences between ON and recognized eating disorders, which would further explain this correlation.

ON is an area of much needed research. It appears as if research is working backwards by determining ON’s prevalence and risk factors prior to its formal establishment. There is a serious need for ON to be recognized by the DSM-5 and the establishment of diagnostic criteria, which can then lead to the development of proper assessment tools and methods of treatment. This is a limitation of all studies examining this topic, and is something future studies should consider addressing.

Additional limitations of our study include our use of indirect recruitment. We recruited our participants through DPD directors, which could have reduced our sample size if they were unwilling to share the information with their students. There was no assessment of dietary



habits/preferences, including veganism/vegetarianism and/or other dietary restrictions for religious or medical reasons. This may have influenced participants' responses when answering questions, especially with the IEQ. The use of ORTO-15 was a limitation in that it failed to address obsessive-compulsive behavior, which is part of ON's proposed criteria (Moroze et al., 2015). We also experienced a technical limitation with Qualtrics linking to the ASA-24 website. Qualtrics generated some duplicate usernames, which led to some students being unable to complete the recall and some dietary recalls had to be excluded. Our dietary data also only examined one day of intake. We did not want to increase our participant burden, however, one day may not be representative of participants' usual intake.

Our study had several strengths. We examined ON behavior in DPD students nationwide, which allowed us to determine differences among geographic locations. In addition, demographic characteristics were representative of RDNs and the students who are studying to earn this credential. The use of multiple measures to assess ON was an additional strength. There are limitations in all ON diagnostic tools; therefore we chose the most commonly used tool (ORTO-15) along with two additional valid and reliable tools (IEQ and EHQ). Lastly, we examined dietary data via a 24-hour food record to compare diet quality between ON and non-ON risk participants. This was the first discovered study to measure diet quality in U.S. DPD students using the HEI-2015 and to examine relationships of diet quality and ON, which contributes to the literature on this subject.

In conclusion, our study showed that over half of U.S. DPD students are at risk for ON. This risk reduces as students move through their program, suggesting that knowledge about nutrition may be protective against ON dietary behaviors. ON may involve changing diet to improve health; therefore, education of balanced diets may be beneficial for its prevention and/or

treatment. Furthermore, diet alone may not be a significant factor for ON development, as symptoms may be more psychological. Regardless of how ON is recognized, pathological “healthy” eating appears to affect a great number of people, which presents a need for further research. Future studies should examine how ON should be characterized and diagnosed. Only then should its prevalence and associated factors be examined.

Table 1. *Participant Characteristics*

<b>Characteristics</b>	<b>n (%)</b>
<b>Sex</b>	
Male	23 (4.0)
Female	543 (95.4)
Transgender male	1 (0.2)
Gender variant/non-conforming	2 (0.4)
<b>Race/Ethnicity</b>	
American Indian or Alaska Native	6 (1.1)
Asian	38 (6.7)
Black or African American	20 (3.5)
Native Hawaiian or Other Pacific Islander	3 (0.5)
White	495 (87.0)
<b>College Classification</b>	
Freshman/first year	31 (5.4)
Sophomore	65 (11.4)
Junior	201 (35.3)
Senior	231 (40.6)
Graduate student	40 (7.0)
<b>College/University Region</b>	
West Coast	30 (5.3)
West Central	55 (9.7)
North Central	108 (19.0)
South Central	61 (10.7)
North East	203 (35.7)
South East	110 (19.3)
<b>Weight Status</b>	
Underweight	17 (3.0)
Normal weight	413 (72.6)
Overweight	118 (20.7)

Table 2. *Descriptive statistics for the ORTO-15, EHQ, and IEQ*

<b>Questionnaire</b>	<b>Mean <math>\pm</math> SD</b>	<b>Median</b>	<b>Minimum</b>	<b>Maximum</b>
ORTO-15	38.1 $\pm$ 4.8	39.0	21.0	51.0
EHQ	45.6 $\pm$ 9.0	45.0	11.0	55.0
IEQ	33.1 $\pm$ 9.2	32.0	26.0	82.0

Table 3. *Median scores for ORTO-15, Eating Habits Questionnaire (EHQ), and Inflexible Eating Questionnaire (IEQ) Score by College Classification*

<b>Questionnaire</b>	<b>Median</b>	<b>p-value</b>	<b>Chi-Square</b>	<b>df</b>
<b>ORTO-15</b>		0.003	15.99	4
Freshman	37.0			
Sophomore	37.5			
Junior	38.0			
Senior	39.0			
Graduate	40.0			
<b>EHQ</b>		0.003	16.28	4
Freshman	47.5			
Sophomore	47.0			
Junior	46.0			
Senior	44.0			
Graduate	41.0			
<b>IEQ</b>		<0.001	27.30	4
Freshman	30.0			
Sophomore	29.0			
Junior	31.0			
Senior	35.0			
Graduate	32.0			

Table 4. *Healthy Eating Index (HEI) Scores and Sub-scores Between Students With and Without Orthorexia Nervosa Tendencies*

<b>HEI Component</b>	<b>n</b>	<b>Mean <math>\pm</math> SD</b>	<b>Standard Error Mean</b>	<b>Maximum Possible Score</b>
<b>Total Vegetable</b>				5
Yes ON	95	4.2 $\pm$ 1.4	0.14	
No ON	76	4.0 $\pm$ 1.4	0.17	
<b>Green and Bean</b>				5
Yes ON	95	3.3 $\pm$ 2.3	0.24	
No ON	76	3.4 $\pm$ 2.2	0.25	

<b>Total Fruit</b>					5
Yes ON	95	3.1 ± 2.1	0.21		
No ON	76	2.7 ± 2.0	0.23		
<b>Whole Fruit</b>					5
Yes ON	95	3.4 ± 2.1	0.22		
No ON	76	3.2 ± 2.2	0.25		
<b>Whole Grain</b>					10
Yes ON	95	4.8 ± 3.9	0.40		
No ON	76	5.3 ± 3.8	0.45		
<b>Dairy</b>					10
Yes ON	95	5.4 ± 3.6	0.36		
No ON	76	5.3 ± 3.5	0.40		
<b>Total Protein</b>					5
Yes ON	95	4.4 ± 1.3	0.13		
No ON	76	4.4 ± 1.3	0.14		
<b>Seafood and Plant Protein</b>					5
Yes ON	95	3.3 ± 2.2	0.22		
No ON	76	3.7 ± 2.0	0.23		
<b>Fatty Acids</b>					10
Yes ON	95	6.6 ± 3.8	0.39		
No ON	76	7.2 ± 3.6	0.41		
<b>Sodium</b>					10
Yes ON	95	3.2 ± 3.4	0.35		
No ON	76	3.8 ± 3.4	0.39		
<b>Refined Grains</b>					10
Yes ON	95	7.8 ± 3.2	0.33		
No ON	76	7.5 ± 3.4	0.40		
<b>Saturated Fat</b>					10
Yes ON	95	6.5 ± 3.6	0.37		
No ON	76	7.0 ± 3.0	0.34		
<b>Added Sugar</b>					10
Yes ON	95	8.5 ± 2.2	0.22		
No ON	76	8.3 ± 2.4	0.27		
<b>Total Score</b>					100
Yes ON	95	64.3 ± 14.8	1.52		
No ON	76	65.8 ± 13.4	1.53		

## Appendix A

## Survey Questions

1. What is your age? \_\_\_\_\_
2. How would you describe your race/ethnicity?
  - a. American Indian or Alaska Native
  - b. Asian
  - c. Black or African American
  - d. Native Hawaiian or Other Pacific Islander
  - e. White
3. What is your sex?
  - a. Male
  - b. Female
  - c. Transgender female
  - d. Transgender male
  - e. Gender variant/non-conforming
  - f. Not Listed: \_\_\_\_\_
4. What is your classification in college?
  - a. Freshman/first year
  - b. Sophomore
  - c. Junior
  - d. Senior
  - e. Graduate student
5. Where is your college/university located within the U.S.?
  - a. West Coast
  - b. West Central
  - c. North Central
  - d. South Central
  - e. North East
  - f. South East
6. What is your weight (lbs.) ? \_\_\_\_\_
7. What is your height ? (ft. and in.) \_\_\_\_\_

Please answer the following questions to the best of your ability about your food beliefs and habits.

## Part I.

1. When eating, do you pay attention to the calories of the food?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never

2. When you go in a food shop do you feel confused?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
3. In the last 3 months, did the thought of food worry you?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
4. Are your eating choices conditioned by your worry about your health status?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
5. Is the taste of food more important than the quality when you evaluate food?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
6. Are you willing to spend more money to have healthier food?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
7. Does the thought about food worry you for more than three hours a day?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
8. Do you allow yourself any eating transgressions?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
9. Do you think your mood affects your eating behavior?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
10. Do you think that the conviction to eat only healthy food increases self-esteem?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never

11. Do you think that eating healthy food changes your life-style (frequency of eating out, friends,...)?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
12. Do you think that consuming healthy food may improve your appearance?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
13. Do you feel guilty when transgressing?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
14. Do you think that on the market there is also unhealthy food?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never
15. At present, are you alone when having meals?
  - a. Always
  - b. Often
  - c. Sometimes
  - d. Never

Part II.

1. When I cannot follow my eating plan I feel very anxious (or nervous).
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree
  - e. Fully Disagree
2. When I do not follow one of my eating rules, then I make an effort to compensate it by following my rules even more strictly.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree
  - e. Fully Disagree
3. For me, having a balanced eating pattern requires strictly following certain rules.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree

- e. Fully Disagree
- 4. Having well defined eating rules makes me feel organized/in control.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree
  - e. Fully Disagree
- 5. I rather follow my eating rules than to eat without any guidance or according to my appetite or will.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree
  - e. Fully Disagree
- 6. If I notice any change in my weight (even a small one), following my diet becomes a priority for me.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree
  - e. Fully Disagree
- 7. I get worried when I do not follow my eating rules, even if it only happens occasionally.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree
  - e. Fully Disagree
- 8. Even if I feel satisfied with my weight, I do not allow myself to ease my eating rules.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree
  - e. Fully Disagree
- 9. I feel proud when I can rigidly follow certain eating rules.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree
  - e. Fully Disagree
- 10. Not following my eating rules makes me feel inferior.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree



- e. Fully Disagree
- 11. To manage my eating through rules gives me a sense of control.
  - a. Fully Agree
  - b. Agree
  - c. Neither Agree nor Disagree
  - d. Disagree
  - e. Fully Disagree

Part III.

- 1. I am more informed than others about healthy eating.
  - a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
- 2. I turn down social offers that involve eating unhealthy food.
  - a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
- 3. The way my food is prepared is important in my diet.
  - a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
- 4. I follow a diet with many rules.
  - a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
- 5. My eating habits are superior to others.
  - a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
- 6. I am distracted by thoughts of eating healthily.
  - a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
- 7. I only eat what my diet allows.
  - a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
- 8. My healthy eating is a significant source of stress in my relationships.
  - a. False, not at all

- b. Slightly true
  - c. Mainly True
  - d. Very True
9. I have made efforts to eat more healthily over time.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
10. My diet affects the type of employment I would take.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
11. My diet is better than other people's diets.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
12. I feel in control when I eat healthily.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
13. In the past year, friends or family members have told me that I'm overly concerned with eating healthily.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
14. I have difficulty finding restaurants that serve the foods I eat.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
15. Eating the way I do gives me a sense of satisfaction.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
16. Few foods are healthy for me to eat.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
17. I go out less since I began eating healthily.

- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
18. I spend more than three hours a day thinking about healthy food.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
19. I feel great when I eat healthily.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
20. I follow a health-food diet rigidly.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True
21. I prepare food in the most healthful way.
- a. False, not at all
  - b. Slightly true
  - c. Mainly True
  - d. Very True

Would you like to complete the 24-hour dietary recall?

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